

GPS Technology for Spacecraft Autonomy

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Abstract

This presentation will describe a miniature GPS-based multi-function instrument to help provide autonomy for spacecraft constellations. The instrument would perform such tasks as: real time navigation with accuracies down to the sub-decimeter level; relative navigation and formation flying to the 1 mm level; real time precise attitude to 3-5 asec with integrated star imager; command and data up-link extraction and interpretation; downlink transmission; high frequency cross-link transmission and reception; all onboard spacecraft computing and event sequencing; a diversity of atmospheric, ionospheric, ocean, and solid earth science measurements; and all onboard data storage. It will also enable ~1 cm after-the-fact precise orbit determination. All of these functions can fit in a small, palm-sized package at a very low recurring cost. Early versions of this instrument are now flying, but some of the more generalized spacecraft functions have not yet been implemented. The time is at hand to deploy a fully autonomous ("fire-and-forget") small constellation to demonstrate formation flying; crosslink satellite-to-satellite communications; and atmospheric, ionospheric, and gravity field measurements. This technology will be applicable to any single platform, static constellation, or reconfigurable constellation that seeks maximum autonomy and minimum operations costs.